Supernova Challenge Quiz for Amateurs & Students

SN Challenge Team

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While the main supernova-classification challenge is aimed for professional scientists, here is a challenge-quiz for amateurs and students. Feel free to use whatever resources are available (books, online, calculator, friends ...). The answers will be posted May 1, 2010, the same date that results are due from the SN-classification challenge.

1. What is a supernova (SN) ?
   (a) two stars that collide
   (b) two galaxies that collide
   (c) an exploding star
   (d) an exploding galaxy
   (e) a racing version of the 1985 Chevy Nova
2. After the initial supernova event, the maximum optical brightness for most SNe occurs after a few
   (a) seconds
   (b) days
   (c) weeks
   (d) months
   (e) thousand years
3. The vast majority of supernovae can be seen at night using
   (a) the naked eye
   (b) binoculars
   (c) a 3" aperture telescope
   (d) large professional telescopes

4. Which type of supernova is most commonly used to study the expansion history of the universe:

   (a) Type Ia
   (b) Type IIa
   (c) Type IIP
   (d) Type IIn
   (e) Type III

5. The supernova type in the previous question is ideal to study the expansion history of the universe because these SNe

   (a) all have nearly the same intrinsic brightness
   (b) emit white light
   (c) are extremely dim
   (d) do not occur in galaxies, making them easy to find
   (e) are visible for thousands of years

6. For each discovered supernova, the *redshift* is measured to indicate

   (a) the ratio of emitted red light to all light
   (b) its dark energy content
   (c) its dark matter content
   (d) how fast it is moving toward earth
   (e) how fast it is moving away from earth

7. With today's instruments, the fastest rate of supernova discoveries is

   (a) few per second
   (b) few per minute
   (c) few per day
   (d) few per month
   (e) few per year

8. The huge energy release of a Type Ia supernova results from

   (a) nuclear fission of heavy elements (like uranium) into light elements

   (b) nuclear fusion of light elements (like carbon & oxygen) into heavier elements (like iron)

   (c) chemical reactions in the outer layers of a star like the Sun

   (d) the gravitational collapse of a massive star to form a black hole

   (e) gravity waves from pulsations in a red giant star

9. Which of the following have *not* been detected coming from a supernova ?

   (a) infrared light

   (b) ultraviolet light

   (c) neutrinos

   (d) silicon

   (e) gravitational waves

10. When sunlight hits our atmosphere, the blue light scatters more than the red light, causing the sky to appear blue. Therefore, when supernova light passes through small galactic *dust* particles, its apparent color seen from above earth's atmosphere (i.e, from the Hubble Space Telescope) is

    (a) redder

    (b) bluer

    (c) unchanged because galactic dust is totally different than air

11. SN 1987A (a type II) was the last supernova visible to the naked eye; the most important scientific result from this event was that

    (a) it is possible to see a supernova with the naked eye

    (b) type II SNe emit neutrinos as expected

    (c) type II SNe emit photons as expected

    (d) type II SNe emit hydrogen as expected

    (e) we learned very little because the Hubble Space Telescope had not yet been launched.

12. The light-travel time of the most distant type Ia supernova ever discovered is approximately

    (a) 10 million light years away
    (b) 100 million light years away
    (c) 1 billion light years away
    (d) 10 billion light years away
    (e) 100 billion light years away

13. The peak brightness of type Ia supernova would appear as bright as our sun at an approximate distance of

    (a) 10 AU (AU = astronomical unit)
    (b) 100 AU
    (c) 1000 AU
    (d) 1 light year
    (e) 10 light years

14. Our Sun will never become a supernova event because it

    (a) is too light
    (b) is too heavy
    (c) does not have enough hydrogen
    (d) is not hot enough
    (e) will be prevented by advanced human technology

15. As viewed through a telescope, a CCD image of a supernova appears as a (an)

    (a) small dot, like a star
    (b) extended fuzzy object like a galaxy
    (c) extended object with a tail, like a comet
    (d) extended structure with random bright and dim spots
    (e) exploding planet from an episode of Star Trek

16. Supernovae were used to discover something known as "dark energy". The main impact of dark energy is to

    (a) cause the Hubble expansion to slow down
    (b) cause the Hubble expansion to accelerate
    (c) dramatically alter the Big Bang theory
    (d) dramatically alter the theory of general relativity
    (e) cause psychological depression

17. Current evidence about dark energy suggests that it is

    (a) contained mostly in stars
    (b) contained mostly in galaxies
    (c) uniformly distributed throughout the entire universe
    (d) created as part of a large energy release such as a supernova
    (e) contributing to global warming

18. If an Earth-size volume were filled only with dark energy, its energy-equivalent mass (E/c^2) would be:

    (a) a billionth of a gram
    (b) a hundredth of a gram
    (c) 1 kg
    (d) 1000 ton
    (e) about the same as the earth's mass

19. The terms "dark matter" and "dark energy" use the word *dark* because they

    (a) hide everything behind it
    (b) do not interact with photons
    (c) do not interact with neutrons
    (d) are still a scientific mystery
    (e) powered the dark side in the original "Star Wars" movie

20. A plausible explanation for dark energy is related to which of the following:

    (a) Boltzmann's constant
    (b) Hubble's constant
    (c) Planck's constant
    (d) Newton's Gravitational constant
    (e) Einstein's cosmological constant

21. If the correct answer to the previous question is the correct description of nature, then the density of dark energy will

    (a) always increase with time
    (b) always decrease with time
    (c) remain constant forever
    (d) alternate between increasing & decreasing
    (e) be unpredictable due to theoretical limitations

22. Which of the following is a unique feature of dark energy that is not shared by any other form of matter and energy:

    (a) it exerts negative pressure
    (b) it has negative energy density
    (c) it causes negative curvature in space-time
    (d) it is created only by supernovae
    (e) it has never been created or detected on earth in a laboratory

23. The main purpose of the professional part of this challenge is to advance our ability to

    (a) distinguish supernova types using radio antennas
    (b) distinguish supernova types from their gamma radiation
    (c) distinguish supernova types without using a spectrum
    (d) discover supernovae with higher efficiency
    (e) raise funding for scientific projects